East Jessamine Middle School

A High Performance School Building

Presented by

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Jessamine/Woodford County Schools

Presentation Overview

1. **Myself**
2. **Jessamine County School District**
3. **East Jessamine Middle School**
4. **Three Elements of a High-Performance School Building**
   - **Building Envelope**
   - **Electrical/Mechanical Systems**
   - **Owner/Operator**
5. **Lessons Learned and Things to Consider for the New School That is Being Built**

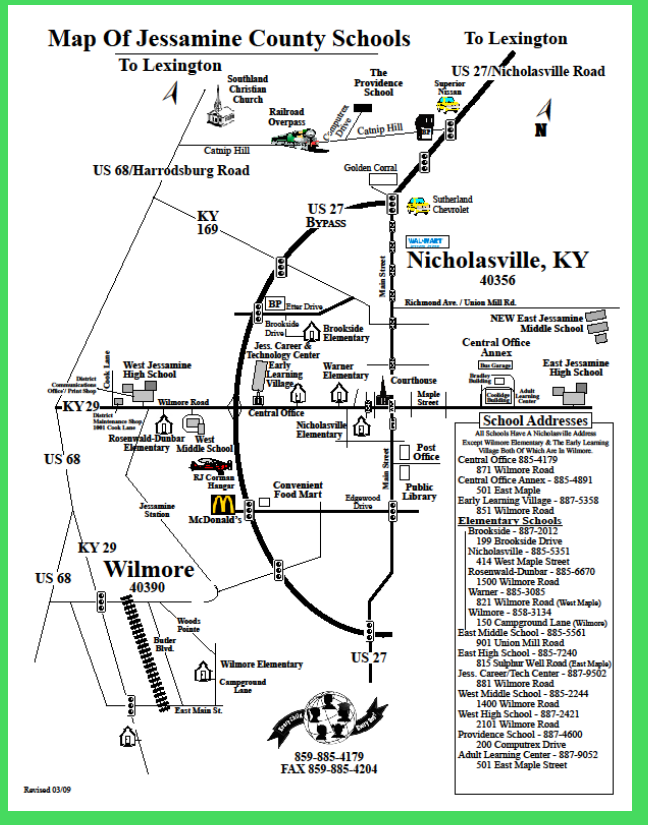
Who am I?

- **One of 35 new SEMP School Energy Managers in KY**
- **Serve Jessamine and Woodford counties**
- **Worked 24 years in Newspaper business as a Technology/ Facility/ Maintenance Manager**

SCHOOL ENERGY MANAGERS PROJECT
SEMP
Kentucky School Boards Association

Jessamine County School District

- Total enrollment of about 8,000 students
- Twelve schools – 2 High Schools, 2 Middle Schools, 5 Elementary Schools, 1 Preschool, 1 Technical School, 1 Alternative School
- Jessamine county has two Energy Star schools Brookside Elementary and the newest one EJMS
- There is a plan in the early stages for new elementary school



East Jessamine Middle School

- **Designed in 2006**
- **Construction began in May 2008**
- **Opened on August 12th, 2009**
- **Enrollment of close to 900 students**

East Jessamine Middle School

- EJMS has an Energy Star score of 90
- 35Kbtu/sq.ft./year < half avg. Ky. School
- Total square footage 134,332 sq. ft.
- It is an all-electric school with the exception of the gas used for the emergency generator
- Utility providers are Bluegrass Electric, Delta Gas, and the City of Nicholasville

Three Elements of a High-Performance School Design

Next Topics:

- **Good Building Envelope**
- **Carefully designed energy efficient mechanical and electrical systems**
- **Good Owner/Operator**

Three Elements of a High-Performance School Design

Good Building Envelope

- **Vigilant architect needed to ensure that the building is well sealed**
- **Long-term partnership with Sherman Carter Barnhart Architects gave the District confidence in envelope construction**
- **Architect performed in-house commissioning on Envelope. Overseeing all work done by contractors.**

Good Building Envelope

- **Roof has more impact than walls**
- **Roof has 4 ½ inch insulation + recovery board for an additional inch (probably best payback on the project)**
- **Roof reflective value 87% for a LEED point**

Good Building Envelope

- **Low E glazing used on all windows**
- **Thermally broken aluminum store fronts (Windows and Doors)**
- **EJMS Insulation is approximately R15 for envelope**

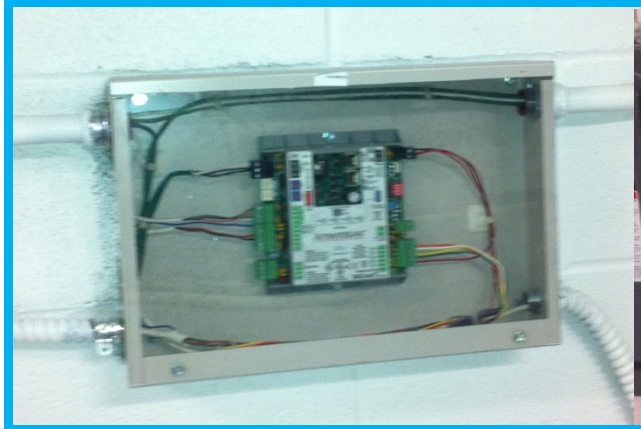
Energy Efficient Mechanical and Electrical Systems

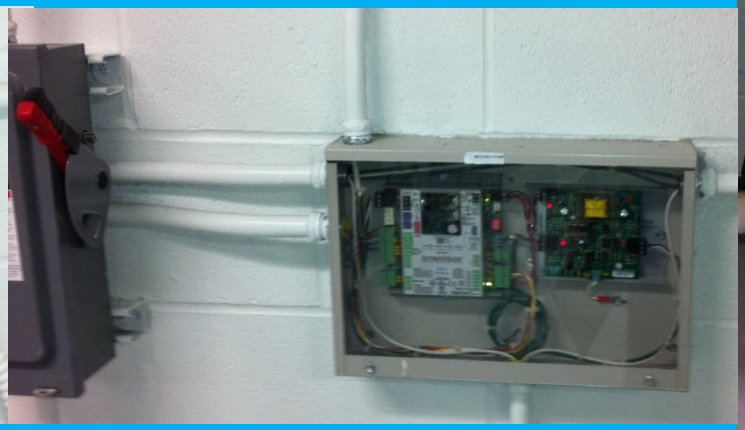
- CMTA Engineering designed the Electrical and Mechanical Systems.
- Donny Crayne P.E., LEED AP was the lead Engineer.

Energy Efficient Mechanical and Electrical Systems

HVAC Geothermal:

- 240 Geothermal wells 300’ deep on 20’ centers





Energy Efficient Mechanical and Electrical Systems

HVAC Geothermal:

- Pumps have Variable Frequency Drives VFDs. When each of the geothermal heat pumps is off the two way valve on the piping is closed which in turn slows down the main geothermal loop pump, reducing the energy required.

Energy Efficient Mechanical and Electrical Systems

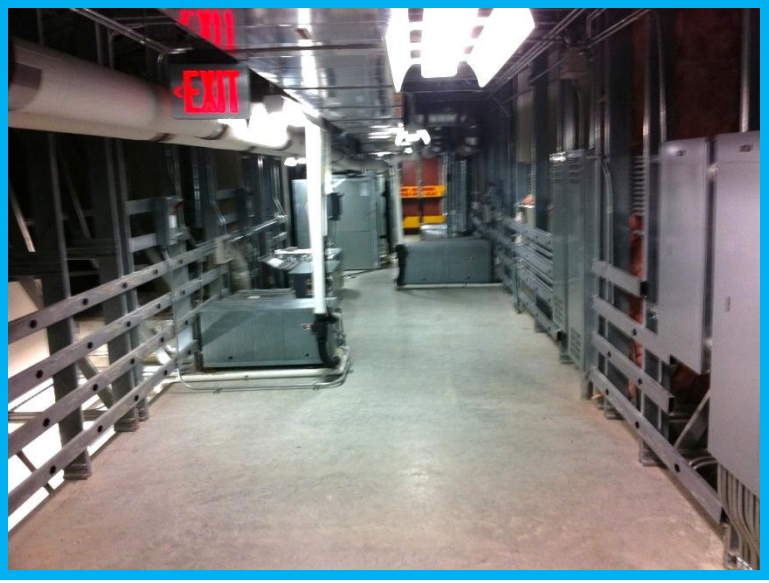
HVAC Geothermal:

- The gym units are fed from geothermal water to water heat pumps that provide either hot or or chilled water. These water to water units also close their water valve when they are off to reduce pumping energy.

Energy Efficient Mechanical and Electrical Systems

HVAC Miscellaneous:

- The classroom heat pumps are located on service mezzanines to ease maintenance. There is no more climbing on a ladder to change filters. The standardized filter sizes are located for easy changing . Systems that are easier to maintain get more maintenance and this keeps them more efficient over the life of the building.



Energy Efficient Mechanical and Electrical Systems

HVAC Miscellaneous:

- Each wing of the school has a dedicated outside air unit. After school activities can be grouped so outside air is not being provided to areas that do not need it.

Energy Efficient Mechanical and Electrical Systems

HVAC Miscellaneous:

- Each Zone has its own Air Handlers and can be isolated from the loop

Energy Efficient Mechanical and Electrical Systems

HVAC Miscellaneous:

- Mechanical Mezzanines make service and maintenance easy

Energy Efficient Mechanical and Electrical Systems

HVAC Miscellaneous:

- Mechanical Mezzanines also allow access to classroom ceilings

Energy Efficient Mechanical and Electrical Systems

HVAC Miscellaneous:

- Separate small cooling unit is used for Server Room which needs to run 24x7

Energy Efficient Mechanical and Electrical Systems

HVAC Miscellaneous:

- Energy consumption is reduced by pre-tempering the outside air with energy recovery wheel units. This unit takes the waste exhaust air from the building and preheats or precools the required fresh air before mechanical cooling or heating is needed.

Energy Efficient Mechanical and Electrical Systems

HVAC Geothermal:

- The gymnasium and cafeteria each have a dedicated HVAC unit with 100% economizer to allow cooling of the highly populated spaces during cool outside weather conditions so no mechanical cooling is required at these times.

Energy Efficient Mechanical and Electrical Systems

HVAC Miscellaneous:

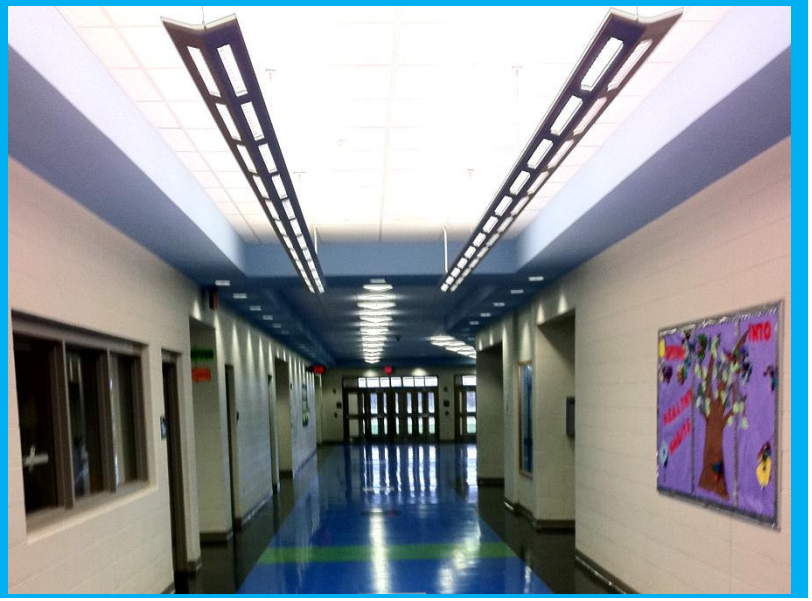
- Warm air naturally rises, so tall spaces like the gym and cafeteria would normally have hot air zones near the ceiling. At East Jessamine the return grilles for these spaces are located near the floor to De-stratify the space and keep the warm air down where the students are.

Energy Efficient Mechanical and Electrical Systems

Electrical Lighting:

- Classrooms oriented North/South for Day lighting (+/- 15 degrees)

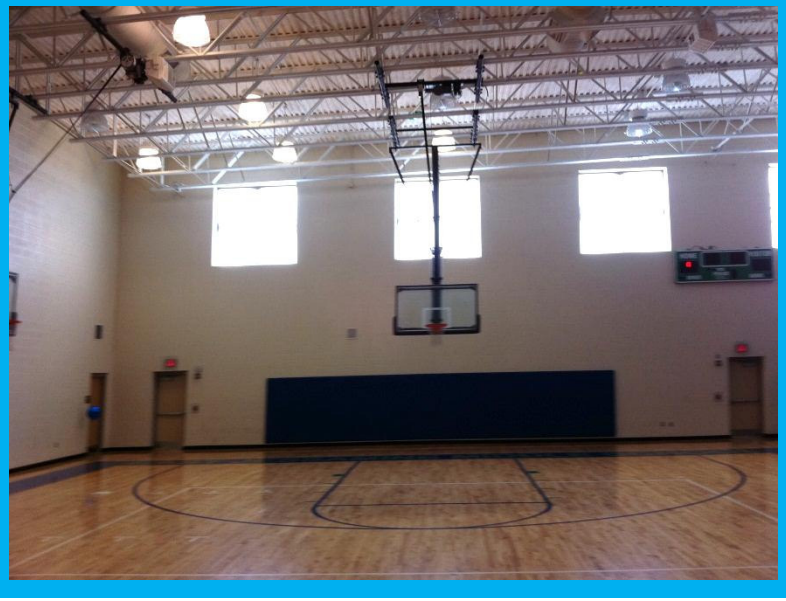
- High efficiency T5 lighting
- Did not over light site
- Programmable lighting control system with room level overrides for after hour functions

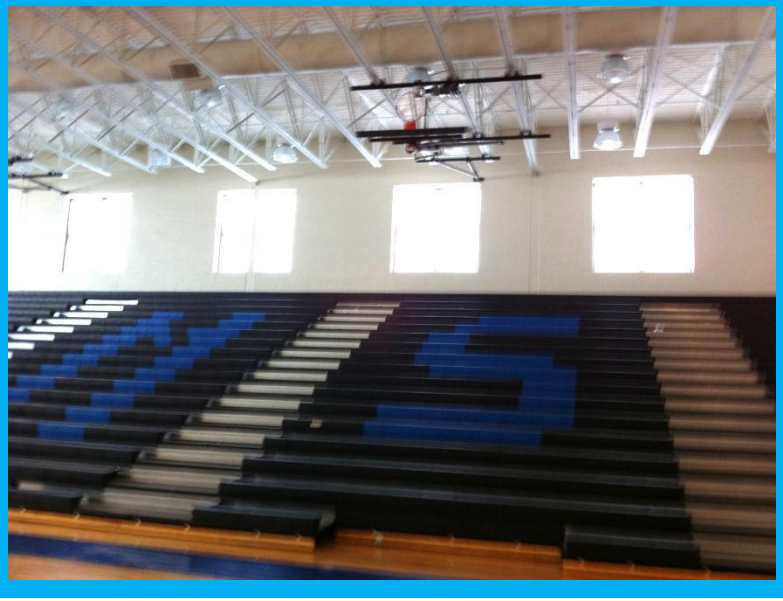


Energy Efficient Mechanical and Electrical Systems

Electrical Lighting:

- Dimmable fluorescent lighting in auditorium instead of traditional quartz
- Gym Day Lighting via refractive glass
- High efficiency fluorescent lighting in gym instead of metal halides – allows rapid light starts





Energy Efficient Mechanical and Electrical Systems

Electrical :

- ***Automated Variable speed controls on kitchen hood***

Energy Efficient Mechanical and Electrical Systems

Water:

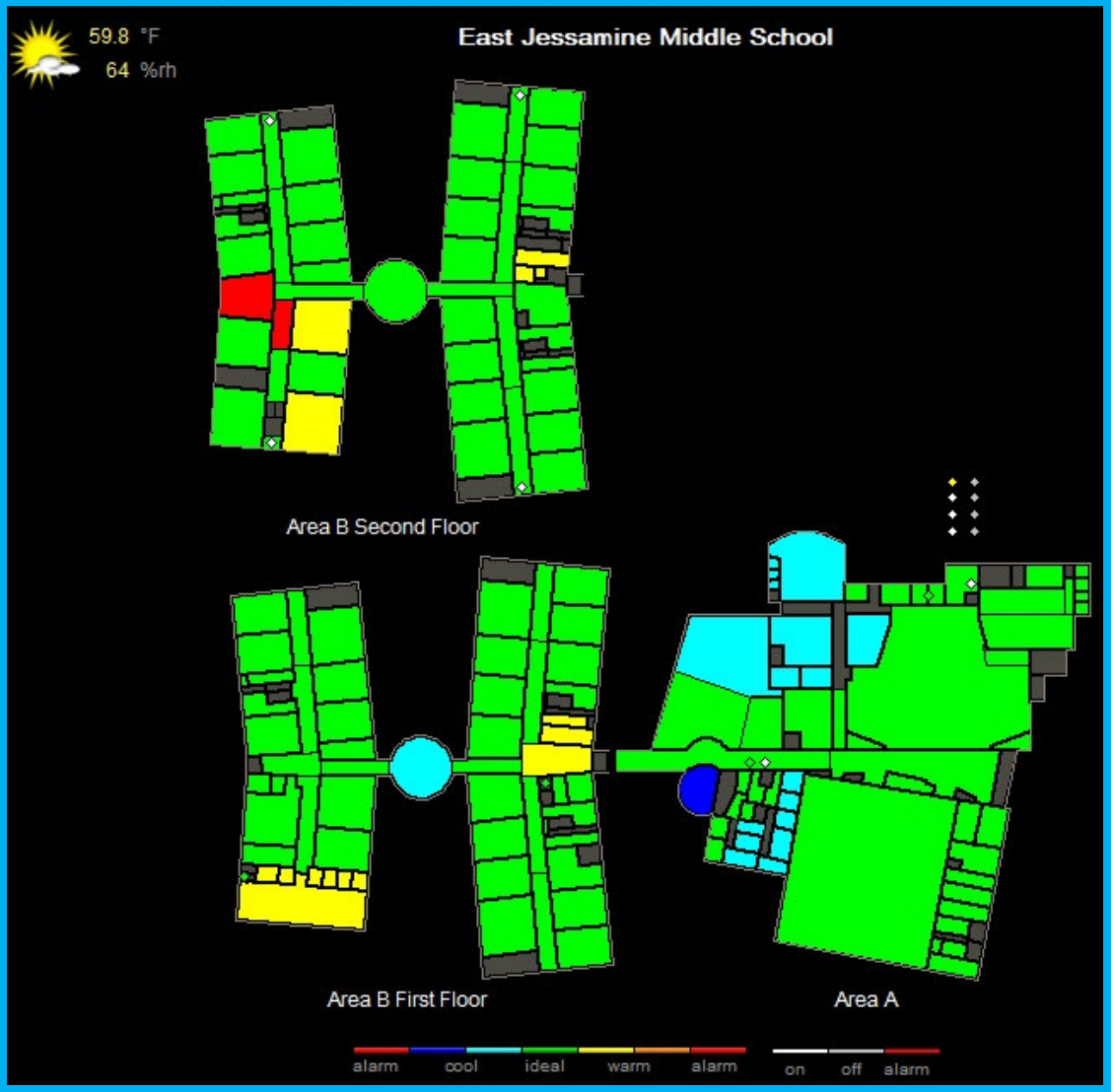
Two separate water heaters; one set to 110 for restrooms and the other set to 140 for kitchen. The water heaters are linked together for redundancy.

Good Owner/Operator

- School Hours are 8:35am – 3:35pm.
  HVAC Setbacks are 8:30am – 3:15pm
- Winter: Use hours 68/After hours 55
- Summer: Use hours 73/After hours 86
- Aggressive set points 55/86
- +/- 1 degree room controls

Good Owner/Operator

The Jessamine County Schools district wide DDC Web Based Control system was extended to monitor the Middle School. This lets the maintenance staff remotely keep closer tabs on the building temperature set points and monitor the occupied and unoccupied times.



Good Owner/Operator

- School Energy Team formed to get students involved in helping the school and community conserve energy.

Energy Efficiency must be accomplished without compromising comfort or functionality

Lessons Learned and New Options to Consider Applying to New School

<u>Kitchen Considerations</u>:

- **Kitchen uses up to 1/3 of the energy for school.**
- **More Low Energy kitchen equipment**

Lessons Learned and New Options to Consider Applying to New School

<u>Kitchen Considerations</u>:

- **Kitchen hood paired with efficient appliances is key to lowering energy use in kitchens**

- **Energy Star is a good source for energy efficient kitchen information**
- **Duke Energy has a Energy Efficient Test Kitchen**

Lessons Learned and New Options to Consider Applying to New School

- **Net Zero ready**
- **Commissioning**
- **Insulated Concrete Forms ICF Walls R25-26**
- **6 inch roof insulation**
- **Solatubes**
- **Light Shelves in all classrooms**
- **Geothermal spacing and sequencing**
- **Off-hour timers for hot water loop pump**
- **Use of two speed compressors on heat pumps**

Lessons Learned and New Options to Consider Applying to New School

Other Possible Considerations:

- **LEED Certification**
- **Clearstory glazing – nano gel – goes from R3 to R10 -** ***Not commonly available – need 3 competitive quotes***
- **Utilize Big A fans in gym and cafeteria**
- **Solar power**
- **Rain harvesting**
- **Automated control for field watering**
- **Separate rain storage wells for field watering**
- **Get rid of water coolers**

Thank You!

East Jessamine middle School